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(71) Applicant (for all designated States except US):	INTERVU, INC. [US/US]; 201 Lomas Santa Fe Drive, Solana Beach, CA 92075 (US).		Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
(72) Inventors; and			
(73) Inventors/Applicants (for US only):	KENNER, Brian [US/US]; 1403 Walnut Creek Drive, Encinitas, CA 92024 (US). COLBY, Kenneth, W. [US/US]; 12707 Gibraltar Drive, San Diego, CA 92128 (US). BROWNELL, Lonnie [US/US]; 826 Birchview Drive, Encinitas, CA 92024 (US).		
(74) Agents:	SCHAFFER, Robert et al.; Darby & Darby, P.C., 805 Third Avenue, New York, NY 10022-7513 (US).		

(54) Title: A SYSTEM AND METHOD FOR OPTIMIZING THE DELIVERY OF AUDIO AND VIDEO DATA OVER A COMPUTER NETWORK

(57) Abstract

Method and apparatus for optimizing delivery of digital content over a computer network. A user specifies through his browser the audio and video data he wants to playback on his screen. A plurality of servers on the network is presented to him, each of which containing at least one copy of specified digital content in at least one digital format. Relative electronic distance over the network between the user terminal and the identified servers are also given to the user in order to let him select one identified server having specified digital content in a designated format and which is determined to be electronically close to the user terminal.

A SYSTEM AND METHOD FOR OPTIMIZING THE DELIVERY
OF AUDIO AND VIDEO DATA OVER A COMPUTER NETWORK

5 The invention relates to a system and method for optimizing
the retrieval and playback of audio and video data
distributed via the Internet. More particularly, this
invention is directed to a software tool which allows the
user to: (a) select optimum delivery sites for more rapid
10 and error free delivery of audio/video data; (b) download
audio/video player software from distributed Internet
servers; (c) detect and update multimedia software
components; and (d) provide easy access to enriched
audio/video content.

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BACKGROUND OF THE INVENTION

The Internet is a loose network of connected computers
spread throughout the world. A message can be sent from any
20 computer on the Internet to any other by specifying a
destination address and passing the message from computer to
computer via a series of "hops." Each computer, or "node,"
on the Internet has a unique Internet address. When an
intermediate computer receives a message in transit, the

A software program known as a "browser" can be used to access and view Web pages across the Internet by specifying the location (i.e. Internet address) of the desired Web page, or more commonly, by "hotlinking" to Web pages. Two 5 of the most popular browsers are Microsoft Internet Explorer, and Netscape Navigator. The desired Web page is specified by a uniform resource locator ("URL"), indicating the precise location of the HTML file in the format "http://internet.address/directory/filename.html".

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Hotlinking is accomplished as follows. The user first accesses a Web page having a known address, often on the computer located at the user's ISP (Internet Service Provider). The ISP is the organization providing Internet 15 connectivity to the user. That Web page can contain, in addition to textual and visual data specified in HTML format, "links," or embedded information (in the form of URLs) pointing to the Internet addresses of other Web pages, often on other computers throughout the Internet. The user, 20 by selecting a link (often by pointing and clicking with a mouse), can then access other Web pages, which can in turn contain further data and/or additional links. When a Web page is accessed, its information is transmitted from the remote computer, wherever in the world it may be located, 25 across the Internet, to the user.

small graphic or text files. However, real time data such as video, has very specific and stringent transfer and display timing requirements. Similarly, software plug-ins or external programs must be received and downloaded intact 5 in order to be functional. This attribute, combined with the rapid growth of the Web and the Internet in general, has led to several problems.

There is now a high and increasing volume of Internet 10 traffic caused by Web page access, and the demand for bandwidth threatens to exceed supply. Furthermore, certain content on the Web is extremely popular. Because current Internet technology provides Web pages from specific or "dedicated" remote site or servers, the most popular sites 15 are often overloaded. According to current Internet technology, each response to a user request is transmitted separately. In other words, if one hundred users request transmission of the same Web page at the same time, one hundred separate transmissions must be made to these users. 20 Because many of these popular Web pages are often being transmitted across many nodes on the Internet, there can be substantial duplication, delays and lost requests, for both the requested data and other, unrelated data being transmitted over the same routes. If a Web server 25 containing video data receives many simultaneous requests

amounts of video-type data traffic. As long as network traffic remains within the limits imposed by network bandwidth, network performance will remain acceptable. However, whenever peak network loads exceed capacity, the 5 downward spiral described above will begin, causing increasing periods of poor network performance.

In an attempt to solve some of the foregoing problems, content providers will spread popular content around the 10 Internet on various servers or delivery sites known as "mirror sites." Each mirror site contains information that is identical to that of the original site. For example, if a popular Web site is located in New York, mirror sites might be located in Los Angeles, London, and Tokyo. 15 Accordingly, if a European user is having difficulty accessing the New York original site, he can hotlink to the mirror site that is geographically closest, i.e. London.

However, mirror sites are not necessarily ideally placed on 20 the network. Although mirror sites may be geographically widely distributed, they might not be sufficiently separated on the network. Returning to the foregoing example, the New York original Web site and the Los Angeles mirror site might both be connected to the same national Internet service

advantage of the existing low cost pricing scheme of the Internet.

Currently, there is no guidance in selecting optimal locations for delivery or mirror sites or methodology that permits a user to determine which mirror site to connect to that will ensure optimum performance. Traditional network analysis techniques such as the "ping" and "traceroute" programs offer a view of network connectivity but provide little understanding of what performance can be expected from providers and mirror sites across the Internet.

Therefore, only "educated guesses" can be made as to where delivery or mirror sites should be located or which mirror sites should be used to optimize performance. Accordingly, a need exists for a method of determining overall network performance and applying that method in a system which enables content providers to locate delivery or mirror sites at optimum locations and users to select optimum mirror sites so that the transmission and delivery of audio/video data and multimedia software over the Internet can be optimized.

Another problem not resolved by the optimum placement of mirror or delivery sites relates to the distribution and storage of audio/video data and multimedia software programs

the subscribing user with a preferred codec and then store video clips in the same compression format recognized by that codec.

- 5 When the service begins to make video clips available over the Internet, it is more likely that the video clips will be requested by a non-subscribing user whose multimedia terminal does not have a codec that recognizes the compression format in which the video clips are stored. If
- 10 this is the case, the user's video request must be redirected to a video clip stored in a compression format recognized by the user's codec or the user must acquire or download a codec program which is capable of decompressing the desired video clip. In many cases, the video request
- 15 cannot be redirected to a video clip with a recognizable format because video clips are not stored in a variety of compression formats due to their large size and the limited storage capacity of the server. In this situation, downloading a new codec is the only alternative.

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A codec program is usually accessible via a link embedded in the web page referencing the requested video. Thus, it is possible to select and download the codec program via the Internet. When a user requests a video clip referenced on a
25 web page, the web page usually prompts the user to acquire

Finally, enriched or enhanced video files are distributed randomly across the Internet at the discretion of the content provider. There is no single source viewer's guide 5 that advises the user of the location of enhanced video files or the availability of improved multimedia software that can be used to view enhanced video files nor a single source program that enables the user to access all of the data. Web pages embedding references to video files are 10 usually encountered by chance when a user "surfs" the Internet. If a user finds a web page referencing a video file and opens it, he may encounter a link to a content provider or video delivery service that provides access to a list of videos in a particular compression format and a link 15 to a codec that can be used to view the videos carried by that provider. However, these content providers do not store videos and codecs in multiple formats and they do not provide links to differently formatted video content or multimedia software stored at other sites around the 20 Internet.

Thus, a need can be seen for a solution that deals with all of the aforementioned problems in a comprehensive way such that improved access to the best video content is assured 25 and the user's enjoyment of Internet-delivered audio and

in the web page query's the user's browser and system components to detect for the presence of the network testing software tool. If the tool is not detected, the user will be queried by the page to download the primary program for 5 the purpose of optimizing the user's video delivery system components. If the user elects to download the primary program, the program can be downloaded as a plug-in to the browser or as a stand-alone program.

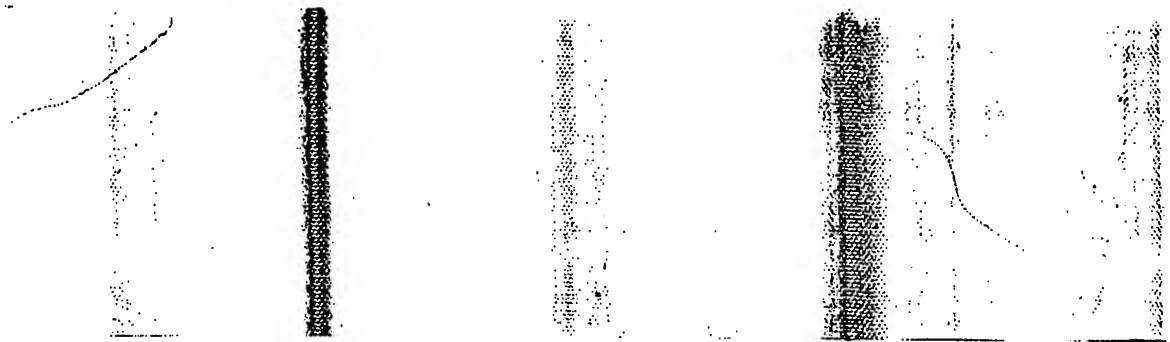
- 10 After downloading, the primary program will initially install and launch the network testing software tool which will be used to locate servers that are "electronically close" to the user terminal. The primary program will download a "delivery site file" from a multimedia database 15 manager maintained by the service provider to the network testing tool. The delivery site file will contain a list of server sites that store multimedia software and upgrades that will be used by the primary program to upgrade the user's multimedia system components. Whenever the user 20 elects to upgrade or install multimedia components to his system the primary program will activate the network testing tool and the tool will conduct a series of network performance tests to determine from the list of servers storing the data required by the primary program, which

best server site to retrieve the data from. Once the primary program receives the data, the primary program will install the software or software upgrades on the user's terminal.

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The primary program can determine what aspects of the upgrades or software programs are required for functionality and selectively install only those attributes thus conserving storage space. In some cases, the primary 10 program may uninstall old software and install a new version of the software rather than an upgrade if doing so facilitates the download and installation of multimedia software in a way that is transparent to the user. In cases where the primary program must close and reopen the browser 15 to permit the installation of software, the primary program will reopen the browser and bring the user back to the web page containing the original video request.

In order to encourage the user to run the primary program 20 and upgrade his existing multimedia software or install new software, the primary program will provide a link to a "most recent release" video directory maintained by the multimedia database manager. The video directory will provide links to video data stored anywhere on the Internet. Each video 25 reference in the directory will indicate the types of



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multimedia database manager so the user can select a video.

In this way, the user is assured of receiving the best and most enriched video in the fastest most efficient way possible.

6. A method according to claim 4, wherein a database indicates the digital formats which can be interpreted at the user terminal.

7. A method according to claim 2, wherein the set of digital formats comprises the formats which can be interpreted at the user terminal.

8. A method according to claim 2, wherein the set of digital formats comprises the formats of the copies of specified digital content on each of the identified servers.

9. A method according to claim 2, wherein the set of digital formats comprises the formats which can be interpreted at the user terminal.

10. A method according to claim 2, wherein the set of digital formats comprises those formats of the copies of specified digital content on each of the identified servers which can be interpreted at the user terminal.

11. A method of optimizing delivery of digital content over a computer network comprising the steps of:

specifying digital content for delivery to a user terminal over a computer network;

identifying a plurality of servers on the network, each of which has at least one copy of specified digital content in at least one digital format;

designating a digital format from a set of available formats;

determining the relative electronic distance over the network between the user terminal and one or more identified servers;

supplying at least one compatible codec from a source selected from the group consisting of a local storage device accessible to the user terminal and a server on the network.

17. A method according to claim 16, additionally comprising

identifying a plurality of servers having a compatible codec;

determining the relative electronic distance over the network between the user terminal and one or more identified servers having compatible codecs;

selecting at least one identified server having a compatible codec and which is determined to be electronically close to the user terminal; and

delivering the codec over the network, from at least one selected server to the user terminal.

18. A method according to claim 16, wherein a compatible codec is supplied from a server when a compatible codec is not found on an accessible local storage device.

19. A method according to claim 16, wherein a compatible codec is updated from a server on the network.

20. A method according to any of claims 1, 2, and 11 wherein the digital content is selected from the group consisting of software, audio content, visual content, graphic content, text content, and any combination thereof.

21. A method according to any of claims 1, 2, and 11 wherein the network is the world wide web.

30. A method according to claim 11 wherein the determining step includes the step of delivering a test file over the network from at least one identified server to the user terminal.

31. A method according to claim 30, wherein electronic distance is determined at least in part by evaluating delivery of the test file for one or both of speed and accuracy.

32. A system for optimizing delivery of digital content over a computer network comprising:

a user terminal in contact with a computer network and having a record of specified digital content for delivery to the user terminal;

a plurality of servers on the network, each of which is identified as having at least one copy of specified digital content in at least one digital format; a testing tool for determining the relative electronic distance over the network between the user terminal and one or more identified servers; and

a downloading tool for delivering digital content from one or more servers on the network to the user terminal.

33. A system according to claim 32, additionally comprising at least one of a database of available digital content and a database of available digital formats.

34. A system according to claim 32, additionally comprising a test file on each of the identified servers.

35. A system according to claim 34, wherein the testing tool employs a downloading tool to deliver the test file from at least one identified server to the user terminal.

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/US 98/10567

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G06F17/30 H04L29/08

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G06F H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	WO 98 40831 A (INTERVU INC) 17 September 1998 see abstract see page 1, line 19 ~ line 31 see page 12, line 23 ~ line 36	1-40
X	WO 96 41285 A (INTERVU INC) 19 December 1996 see abstract see page 1, line 13 ~ line 16 see page 7, line 23 ~ line 31 see page 41, line 27 ~ line 28	1,32
		-/-

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentann 2
NL - 2280 HV Rijswijk
Tel: (+31-70) 340-2940, Tx: 31 851 epo nl
Fax: (+31-70) 340-3016

Authorized officer

Adkhis, F

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 98/10567

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9840831 A	17-09-1998	NONE	
WO 9641285 A	19-12-1996	AU 6113996 A EP 0834143 A	30-12-1996 08-04-1998